GENETIC INVENTORY OF WESTSLOPE CUTTHROAT TROUT IN THE NORTH FORK CLEARWATER BASIN, IDAHO

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ABSTRACT

Introgression by exotic trout has been documented as the greatest threat to the conservation of native westslope cutthroat trout (*Oncorhynchus clarki lewisi*) in northern Idaho and western Montana. Genetically pure populations of westslope cutthroat trout are thought to remain in less than 4% of the historic range. Although the North Fork Clearwater drainage is considered a stronghold for populations of westslope cutthroat trout in Idaho, rainbow trout (*O. mykiss*) and Yellowstone cutthroat trout (*O. c. bouveri*) have been widely introduced in the drainage. Rainbow trout are present throughout the North Fork Clearwater River and into the major tributaries, potentially threatening the genetic integrity of wild westslope cutthroat trout in most of the drainage. Currently, Dworshak resident fish mitigation releases rainbow trout into Dworshak Reservoir, the lower 86.2 km of the North Fork Clearwater River. These rainbow trout move considerable distances upstream into the free-flowing portions of the drainage. To determine the extent of introgression in the North Fork Clearwater drainage, we will use non-coding sequences of nuclear DNA. The genetic inventory will allow us to make management recommendations for mitigation in the drainage that is compatible with the persistence of native westslope cutthroat trout.

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INTRODUCTION

I Hybridization with exotic trout is considered the greatest threat to the conservation of the native westslope cutthroat trout (*Oncorhyncus clarki lewisi*) in northern Idaho and western Montana (Allendorf and Leary 1988). Westslope cutthroat trout is reduced substantially in its historic range (Allendorf and Leary 1988. Rieman and Apperson 1989). In Idaho, strong and genctically pure populations are thought to remain in less than 4% of its native range (Ricman and Apperson 1989). Although several studies have determined that genetically pure populations of westslope cutthroat trout remain in less than 2.5% of the historic range in Montana, little genetic sampling has been done in Idaho (Allendorf and Leary 1988, Rieman and Apperson 1989). Introduced rainbow trout (*O. mykiss*) and Yellowstonc cutthroat trout (0. *clarki bouvieri*) will freely hybridize with westslope cutthroat trout producing fertile offspring. This cxtensivc hybridization will infuse exotic genes into the native population. creating a hybrid swarm (Gyllensten et al. 1985. Allendorf and Leary 1988, Lcary et al. 1995). The hybrid swarm permanently alters the gcnetic composition of the native trout, losing the local adaptations and reducing survival and fertility (Allendorf and Leary 1988, Leary et al. 1995).

The North Fork Clearwater River is thought to have relatively strong populations of westslope cutthroat trout (Johnson 1992). However, rainbow trout and Yellowstonc cutthroat trout have been widely introduced in the drainage. Furthermore, the completion of Dworshak Dam near the mouth of the North Fork Clearwater River has caused a large loss of riverine habitat and blocked anadromous runs of salmon and steelhead (0. *mykiss*). The stocking of rainbow Trout Into Dworshak Reservoir is used to mitigate the losses caused by the dam. Extensive movement of hatchery rainbow trout in the basin threatens the indigenous westslopc cutthroat trout In more than 75% of the drainage. Using the results of the genetic inventory. We will make management recommendations for resident fish mitigation in Dworshak Reservoir based on the persistence and wise management of indigenous westslope cutthroat trout populations in the drainage.

GENETIC BACKGROUND INFORMATION

Genetic Analysis

Genetic analysis can detect introgression and classify individual fish as pm-c, F, hybrid, F_2 hybrid, or numerous combinations of hackcrosscs. Gcnctic identity of an individual is determined by the proportion ofDN.4 unique to each species. WC selected analysis of nucleat DNA non-coding sequences for reliability, non-intrusive sampling. and parental inhcritancc. The non-intrusive sampling will require only a small tin clip. Unlike mitochondrial DNA, nuclear DNA reflects the equal genetic contribution of each parent to the offspring directly detecting hybridization and introgrcssion (Wit-gin and Waldman 1994). The genetic lab work will he done by Fred Allendorf and Paul Spruell at the University) of Montana, Division of Biological Sciences.

A genetics reference sample is being developed to identify markers for salmonids introduced into the study area that may hybridize with westslope cutthroat trout. The nuclear DNA markers identified in the reference sample will he correlated with protein electrophoresis to ensure accuracy. To determine the species of trout included in the reference sample we researched trout introduced to the drainage from stocking records. The reference sample includes: westslope cutthroat trout (pure), westslope cutthroat trout (from McCall hatchery), Henry's Lake cutthroat trout. rainbow trout (Arlee and Shasta strains), and steelhead. The introductions of these species and strains of trout are summarized in the section below.

Steelhcad, anadromous rainbow trout, are included in the reference sample because Dworshak Dam artificially isolated parr in the drainage. These steelhead parr may have survived and residualized. Residualired steelhead, reduced in size, potentially may hybridize with the native. wild cutthroat trout. The presence of a steelhead genotype above Dworshak Dam has not been tested. and whether residualized steelhead and westslope cutthroat trout will hybridize is unknown Although westslope cutthroat trout in the North Fork Cleat-water drainage evolved with salmon. steelhead. mountain whitefish (*Prosopium williamsoni*), and bull trout (*Salvelinus confluentus*), westslope developed a distinct genotype, phenotype, and behavior (Rieman and Apperson 1989). Genetically, westslope cutthroat trout are significantly different from the other subspecies of cutthroat trout and rainbow trout (Allendorf and Leary 1988). This genetic distance is far greater than seen in other conspccitic fish (Allendorf and Leary 1988).

Sites will be electrofished to capture fish. Fin clips from 25 cutthroat, rainbow, and/or hybrid trout will bc preserved in 95% ethanol. Sites will he selected for a representative sample throughout the free-flowing sections of the drainage and for monitoring potential. We will attempt to locate genetically pure westslopc cutthroat trout subpopulations that may be able to reproductively support other populations in an area. Thcreforc. some sample sites may he close enough for fish to move between them, as discussed in Rieman and MacIntyrc (1993). Data collected at each site will include: visual description of the trout from which tissue samples arc taken. density estimates on all salmonids present, and habitat variables. The visual trout

descriptions will be used to investigate morphological characteristics, such as spot pattern, parr marks, and jaw length, that may be useful in identifying cutthroat X rainbow trout hybrids in the field. Field identification will be compared to the genetic identification of the trout to calculate our visual accuracy. Habitat measurements will include: width, depth, gradient, habitat type, cover, woody debris, sediment size, and embeddedness. Habitat variables at each site will be correlated with relative abundances of the trout.

Stocking History

Salmonid stocking in the North Fork Clearwater basin has primarily occurred in Dworshak Reservoir and the alpine lakes. The Dworshak Resident Fish Mitigation goal is to stock 100,000 pounds of rainbow trout into the reservoir. The actual stocking varies due availability of healthy trout. In the 1980s quantities of rainbow trout ranged from 5,000 to 87.000 pounds of rainbow trout. The stocking in the 1990s has been sporadic, no rainbow trout were stocked in 1991, 1994, and 1995. and quantities ranged from 10,000 to 20,000 pounds. The Idaho Department of Fish and Game (IDFG) alpine lake stocking program releases approximately 30,000 pounds of trout into 28 lakes in the drainage. Most of these lakes are stocked with westslope cutthroat trout. hut 5 lakes are stocked with rainbow trout for an exotic species fishery. Although wcstslope cutthroat trout have constituted most of the introduced fish in the mountain lake stocking program for the last decade, genetic tests in 1986 showed that these hatchery westslope were 2% rainbow trout (Leary 1986).

The amount ofmovement of stocked trout from release points will determine the extent of introgression in the drainage. Unfortunately, rainbow trout released in Dworshak Reservoir have been documented 88 km upstream in Kelly Creek (Ball and Pettit 1974). Because many of the headwater lakes wcrc naturally barren. it is likely that some stocked fish would migrate into adjacent stream segments seeking more suitable habitat. Downstream movement of stocked trout from headwater lakes has been observed in other drainages (B. Rieman, USFS Fisheries Biologist. personal communication). Therefore. much ofthc drainage is susceptible to introgression because many of the tributaries of the N F Clearwater River may he accessihlc to upstream migrating rainbow trout from Dworshak Reservoir, or downstream migrating trout from lakes in the headwaters.

The IDFG stocking records for the high mountain lakes in the drainage lists 51 of67 named lakes as stocked with variations of the following species and strains: cutthroat trout (subspecies unspecified), rainbow trout (strain unspecified), cutthroat X rainbow trout hybrid. Henry's Lake cutthroat trout, westslope cutthroat trout, golden trout, brook trout. kamloops, and grayling. Thirty of these 51 stocked lakes have had rainbow trout or cutthroat X rainbow trout hybrid introductions, and 17 lakes have had Henry's Lake cutthroat trout introductions. Less than 5 lakes. of the 16 named, unstocked lakes. may maintain naturally reproducing populations of westslope cutthroat trout. Two of these unstocked lakes arc reported as fish hearing (Fish Lake in the headwaters of the Little North Fork Cleat-water River, and Lost Lakes in the headwaters of Cayuse ('reck). However, considering the extent of lake stocking in the area, it is unlikely that

these lakes have never been stocked.

A smaller, IDFG stream stocking program released rainbow trout into 5 tributaries in 1968-l 969 (Quartz Creek, Kelly Creek, Orogrande Creek, Weitas Creek, and Long Creek). Rainbow trout were also regularly released into the mainstem of the North Fork Clearwater River until 1981. Recent fish distribution studies show that rainbow trout are present in all these streams (Hunt and Bjomn 1991, Clearwater Biostudies, Inc. 1992b, 1991a. Isabella Wildlife Works 1996a), indicating that these distant introductions may have established naturally reproducing populations of rainbow trout.

Fish Distribution

Since 1989. fish distribution data have been published for more than 100 streams in the North Fork Clearwater drainage. According to these recent data, streams are classified as: suspected pure, suspected introgression, known introgression, and complete replacement by rainbow trout. Because westslope cutthroat and rainbow trout freely hybridize, my suspected genetic status assumes introgression has occurred wherever rainbow trout and cutthroat trout co-exist. Suspected pure areas did not have exotic trout documented in distribution studies, and/or maintained cutthroat trout populations upstream of known fish barriers in unstocked tributary drainages. Potential fish barriers were documented in 49 of 79 surveyed streams in the drainage (Clear-water Hiostudies Inc. 1995a, 1995c, 1994a, 1994c, 1992b, 1991a, 1991b, 1991d, 1991e, 1991g: 1989a, 1989b, Isabella Wildlife Works 1996a, 1996b, 1996c, 1996d, 1995). Many of these barriers have cutthroat trout upstream, indicating protection from upstream migrating rainbow trout (Clearwatcr Biostudies Inc. 1995a, 1995c, 1994c, 1991a, 1991b, 1991d, 1991g, 1989a. 1989b, lsabella Wildlife Works 1996b, 1996c, 1996d. 1995).

The genetic classifications of streams in the drainage are summarized below (Table I, Fig. 1). The drainage is divided into 10 major free-flowing sections (Table I). Rainbow trout are present in all 10 sections of the drainage (Hunt and Bjomn 1991, Moftitt and Bjornn 1984, Skille 1991, Clearwater Biostudies 1995a. 1995c, 1994b, 1994c, 1993, 1992a, 1992b, 1991a, 1991e, 1991f, 1991g, 1991 h, 1989a. Isabella Wildlife Works 1996a, 1996d, 1995). The Upper North Fork, Black Canyon, and upper portion of Kelly Creek sections are thought to maintain some genetically pure westslopc cutthroat trout populations (Clearwater Biostudies Inc. 1994a. Isabella Wildlife Works 1996b, Hunt and Bjomn 1991). Rainbow trout have been observed in the lower portions of the Kelly Creek drainage, and suspected hybrids have been recorded in Ruby Creek, a tributary in the lower portion of the Kelly Creek drainage (Moffitt and Bjornn 1984, Hunt and Bjornn 1991, Clearwater Biostudies Inc. 1995a, 1991f, 1989b, Isabella Wildlife Works 1996d).

Little information is available for Little North Fork Cleat-water and Cayusc Creek sections, howcvcr some degree of introgression is suspected. Rainbow trout are present in the Little North Fork Clearwatcr mainstem and in the lower areas of 8 tributaries (Skille 1991). Because rainbow trout are present throughout most of the Little North Fork Clearwater drainage, I suspect that introgression has occurred. although some genetically pure populations might exist

Table I. North Fork Clearwater sections, section boundaries, and genetic status of wcstslope cutthroat trout populations

SECTION	BOUNDARIES	SUSPECTED GENETIC STATUS
Elk Creek	Major subdrainage (lower portion inundated by Reservoir)	currently no known cutthroat trout populations
Little North Fork River	Major suhdrainage (lower portion inundated by Reservoir)	extensive introgression on mainstem and lower sections of tributaries, potentially pure populations in headwater areas but unknown
Lower North Fork	slackwater to Washington Creek	suspected introgression widespread, rainbow trout abundant in lower Quartz. Skull, Isabella, and Beaver Creeks
Middle North Fork	Washington Creek to Kelly Creek	suspected introgression widespread, rainbow trout abundant in 4th of July and Washington Creeks
Orogrande Creek	subdrainage	extensive suspected introgression, rainbow) trout widespread
Weitas Creek	major subdrainage	suspected introgression
Black Canyon	Kelly Creek to Cedars	suspected introgression, tributary headwater lakes heavily stocked
Kelly Creek	major subdrainage	introgression in lower portion of drainage, suspected pure in upper portion of drainage
Cayusc Creek	major subdrainage of Kelly Creek	introgression in lower portion of drainage? suspected pure in upper portion of drainage
Upper North Fork	, Cedars to headwaters	mostly pure, potential introgression in Meadow Creek, lower Long Creek. and lower Lake Creek

in the headwatcr areas. Rainbow trout are present in the lower half of Monroe Creek, a tributary approximately half way up Cayuse Creek (Clearwater Biostudies Inc. 1994b). Because rainbow trout arc present here. I suspect introgression has occurred in the lower half of the Cayuse Creek drainage Suspected pure populations may remain in the upper half of this drainage. Extensive introgrcssion is thought to have occurred in the remaining sections: Lower North Fork, Middle North Fork. Weitas Creek. and Orogrande Creek (Clearwater Biostudies Inc. 1996, 1995b, IO95c. 1992b, 1991c, 1991d, 1991g. 1991h, Isabella Wildlife Works 1996c, 1995). In these

sections. Washington Creek, Skull Creek, Collins Creek, and Beaver Creek are classified as complete replacement by rainbow trout (Hunt and Bjomn 1991, Moffitt and Bjornn 1984). The Elk Creek drainage currently does not support cutthroat trout populations.

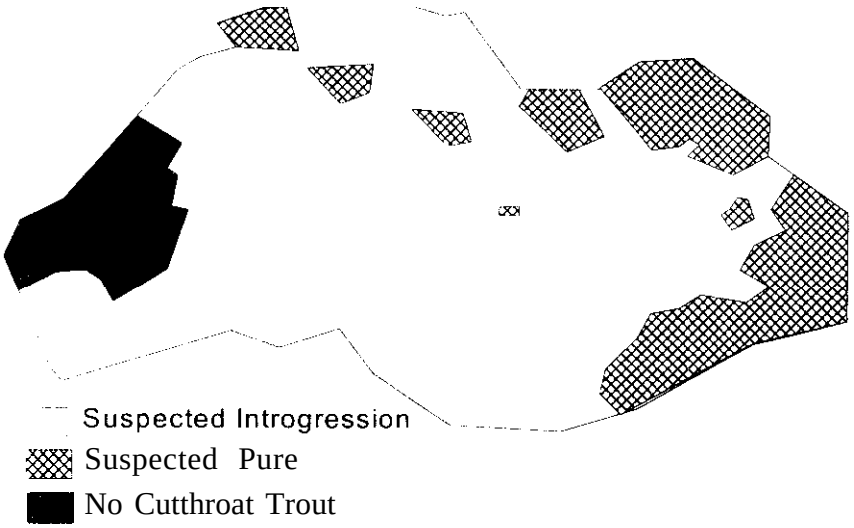

Fig I. Suspected genetic status of westslope cutthroat trout populations in the North Fork Clearwater drainage. Suspected status shown here is based on summer distribution of trout, stocking history, and locations where suspected hybrids have been documented.

Historically, three life history forms of westslope cutthroat trout are present in the North Fork Clearwater basin: adfluvial, fluvial, and resident (Johnson 1992). The fluvial and adfluvial fish contribute more to the fishery because they attain larger sizes and utilize more desirable angling habitat. However, due to stocking practices, the genetic purity of these life history forms may be more vulnerable than the resident form. Fish Lake (Lake Cr), the only documented adfluvial population of westslope cutthroat trout in the drainage, was stocked with unspecified cutthroat trout. Unfortunately. there is little information on the behavior, migrations, or abundance of the different life history forms in the drainage.

Mitigation Activities

Dworshak resident fish mitigation has established kokanee salmon (0. *nerka*), rainbow trout, and small-mouth bass *(Micropterus dolomieui)* fisheries in the Reservoir (Maiolie et al. 1993). Kokanee, released 1972-1979, are currently observed throughout the drainage during spawning migration, showing that introduced fish have access to the uppermost tributaries in the drainage (Clearwater Biostudies Inc. 1992a, Isabella Wildlife Works 1996d. 1995). Although kokanee salmon and small-mouth bass stocking has established these exotic fish in the Reservoir, they do not interfere with native fish populations remaining in the free-flowing areas of the

drainage. However, because of suspected interaction of rainbow trout with the native, wild wcstslope cutthroat trout in the drainage. Maiolie et al. (1993) recommends minimizing rainbow trout stocking to 10.000 pounds of catchables per year into the Reservoir. Catchable size trout arc thought to be more likely to remain in the Reservoir. whereas the subcatchable and fingerling rainbow trout wcrc found extensive distances into the free-flowing sections of the drainage (Hall and Pettit 1974). The Ncz Perce Tribe is currently involved with IDFG, the Army Corps of Engineers. and the U. S. Fish and Wildlife Service in formulating a long-term resident fish mitigation plan for the Reservoir.

Pending the results of the genetic inventory in the North Fork Clearwater basin, we will make management recommendations based on the persistence and wise management of native westslope cutthroat trout populations. Minimal impact to the native fishery should be a priority of fish mitigation.

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